REMARKS

Claims 1-29 are pending in the present application. Reconsideration of the claims is respectfully requested.

I. Telephone Interview of January 23, 2003

Applicant refers Examiner to the telephone interview conducted between Applicant and Examiner Paul Ip. In that interview it was agreed that, because of inability to reach Examiner Inzirillo to discuss the 35 USC 112 second paragraph rejection of the Office Action dated 10/24/02, that the next Office Action would not be made final.

II. 35 U.S.C. § 112, Second Paragraph

The Examiner has rejected claims 1-29 under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter, which applicants regard as the invention. This rejection is respectfully traversed.

In rejecting the Claims, Examiner states:

> Claim 1 recites a semiconductor laser in the preamble, and a waveguide with an outcoupling in the body of the claim. However, no structure to support a semiconductor laser is recited, nor is there any structural relationship recited to tie together the laser and the waveguide.
>
> Claim 7 recites a semiconductor laser in the preamble, and a waveguide, first and second sets of electrodes, and an outcoupling in the body of the claim. However, no structure to support a semiconductor laser is recited, nor is there any structural relationship recited to tie together the laser and the waveguide.
>
> Claim 14 recites a semiconductor laser in the preamble, and a cavity with an outcoupler and a gain region in the body of the claim. However, no structure to support a semiconductor laser is recited, nor is there any structural relationship recited to tie together the laser and the cavity.
>
> Claim 21 recites semiconductor laser system in the preamble, and a cavity with an outcoupling aperture, gain region and reflective layer. However, no structure to support a semiconductor laser is recited, nor is there any structural relationship recited to tie together the laser and the cavity.
>
> Claim 27 recites semiconductor laser system in the preamble, and a cavity with an outcoupling aperture, gain region and reflective layer. However, no structure to support a semiconductor laser is recited, not is there any structural relationship recited to tie together the laser and the cavity.

The lack of this structure renders these claims and all dependent claims indefinite. The following Rejection on the merits is issued in light of this indefiniteness.

Applicant respectfully believes that Examiner has misconstrued the terms of the Claims. For example, with respect to Claim 1, Examiner states: "Claim 1 recites a semiconductor laser in the preamble, and a waveguide with an outcoupling in the body of the claim. However, no structure to support a semiconductor laser is recited, nor is there any structural relationship recited to tie together the laser and the waveguide."

It is respectfully asserted that the waveguide is part of the laser itself, not a separate structure as the Examiner's rejection suggests. The waveguide comprises the cavity in which photons resonate. The reflectors in Claim 1 are recited as being at both ends of the waveguide.

This reasoning applies to all the claims rejected for indefiniteness. For example, Claim 27 recites a cavity, reflectors, an outcoupling aperture, and a gain region. These elements comprise the claimed "semiconductor laser system" as recited in the preamble. The cavity is part of the laser, not a separate structure which needs to be tied to the laser.

It is respectfully asserted that one of ordinary skill in the art would not find the present claims indefinite, and the bounds of the claimed invention would be apparent by the claim language.

Therefore the rejection of claims 1-29 under 35 U.S.C. § 112, second paragraph is believed overcome.

III. 35 U.S.C. § 103, Obviousness

The examiner has rejected claims 1, 2, 4-9, 12-15, 17, 18, 20, 21, 23 and 25-28 under 35 U.S.C. § 103(a) as being unpatentable over Ono US 5,088,097 (herein after known on Ono) in view of Lo US 5,491,710 (herein after known as Lo) and Miyake et al. US 5,515,354 (herein after known as Miyake). This rejection is respectfully traversed.

Ono teaches in Fig. 3 a semiconductor laser with a waveguide portion 20. The waveguide region 20 has two reflectors made up of two gratings 18 and 18'. The gratings are distributed Bragg reflectors, and are seen to vary laterally and longitudinally with respect to the cavity. Ono has a first set of electrodes made up of electrodes 16 and 17 to modulate the light. Ono has a second set of electrodes made up of electrodes 15 and 17. Ono has an active region 12 located between the reflectors. As is evident in Fig. 3 Ono, the gain region has a plurality of sections. One of the sections is a modulation portion that adjusts the phase of the light.

Ono fails to teach first order gratings. However, Lo teaches first order gratings. See Lo Fig. 11, reference numeral 110, and column 7 lines 27-30. Lo states that the reason he use the first order gratings as reflectors in a cavity is because the efficiency they lend a system. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Ono with the first order gratings as taught by Lo. Furthermore, Lo shows in Fig. 11 that the gratings each have a portion that act as outcoupling apertures. The emitted light lambda1 and lambda2 indicate where the outcoupling aperture portions are. Lambda1 and Lambda2 are out coupled normal to the surface of the laser. Since the outcoupling gratings and not past the outer edges of the gratings, they can be considered to be between the gratings. The gratings reflective properties are such that they emit only a first order beam, while the second order and higher are reflected downwards.

Both Ono and Lo fail to teach a reflective layer positioned on the outcoupling aperture. Nor do they teach a holographic element. However, Miyake teaches these limitations. Fig. 1 of Miyake shows the outcoupling aperture A being used in a laser system. A close up view is shown in Fig. 2. The outcoupling aperture 2 is comprised by a grating 13a made on the surface 13 of a substrate. The back of the substrate has a reflective coating 20. Column 4, lines 22-35, describe the aperture. Therein Miyake describes the element as a holographic mirror 12. Miyake does not mention that the reflective layer is made of a dielectric material. However, dielectric reflective layers are very well known. One could be easily substituted for the metal reflective layer of Miyake. As for reflecting the light downwards, the direction is arbitrary. If the substrate 10 of Fig. 1 of Miyake were below the holographic element, the holographic element could be oriented to direct the beam to the substrate just by turning it. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Ono in view of Lo as taught by Miyake.

ANALYSIS

Independent Claim 1 states:

1. A semiconductor laser device, comprising:

a waveguide having separate first order reflector gratings at both ends of said waveguide;

an outcoupling location positioned between said gratings on said waveguide, connected to couple light out of said waveguide.

The Examiner cites Ono as teaching,

a semiconductor laser with a waveguide portion 20. The waveguide region 20 has two reflector gratings 18 and 18'. The gratings are distributed Bragg reflectors, and are seen to vary laterally and longitudinally with respect to the cavity.

Office Action of 10.24.02, page 4.

Later on page 4, the Examiner continues to cite the references against Claim 1 by adding:

Furthermore, Lo shows in FIG. 11 that the gratings each have a portion that act as outcoupling apertures. The emitted light lambda1 and lambda 2 indicate where the outcoupling aperture portions are. Lambda1 and lambda2 are out coupled normal to the surface of the laser. Since the outcoupling gratings are not past the outer edges of the gratings, they can be considered to be between the gratings.

Hence, Ono is cited against Claim 1 for showing the limitations: "a waveguide having separate first order reflector gratings at both ends of said waveguide;" while Lo is cited as showing: "an outcoupling location positioned between said gratings on said waveguide, connected to couple light out of said waveguide."

It is respectfully asserted that Ono and Lo are not properly combinable in this manner, and that the teaching of Ono and Lo teach away from such a combination. Further, Lo doesn't teach the limitation of, "an outcoupling location positioned between said gratings," as claimed in Claim 1.

Ono and Lo are not properly combinable because Ono deals with two separate reflector gratings while Lo deals with a single grating that serves to both reflect and outcouple light.

FIG. 10 of Lo describes an embodiment with a horizontal cavity 109, which uses second order grating 106 to reflect light within the cavity. Light is coupled out of grating 106. (It is noted that grating 108 is part of a different cavity 109 as shown by Lo, which emits light of a different wavelength and is thus a different laser diode.) Grating 106 of FIG. 10 does not teach, "an outcoupling location positioned between said gratings," as claimed in Claim 1, because grating 106 is only a single grating. Light is coupled out of grating 106 and reflected within the cavity 109 by grating 106.

Similarly, in FIG. 11, Lo shows grating 106 being divided into multiple portions 110, 112, 114 of different phase. Though Lo refers to these portions as "gratings," they are all part of grating 106. For example, Lo states,

> In the variation illustrated in FIG. 11, the diffraction gratings 106, 108 include both first and second order gratings 110, 112, with a phase shift region 114 in the middle of the second order grating 112.

Hence, it is respectfully asserted that Lo only teaches a single grating with different phase at different locations, part of which reflects light in the waveguide and part of which couples light out of the waveguide. The Examiner states that, "Since the outcoupling gratings are not past the edges of the gratings, they can be considered to be between the gratings." However, being in the middle of a grating, even a grating with different periods, does not fulfill the claimed limitation of, "an outcoupling location positioned

between said gratings..." as in Claim 1 (emphasis added) because Claim 1 also includes the limitation of, "a waveguide having **separate** first order reflector gratings...." (Emphasis added.) If the two reflector gratings are "separate," they cannot be part of the same grating 106 as is shown in Lo.

Furthermore, this teaching of Lo is not properly combinable with Ono, which could not implement a grating with multiple blazings to act as both reflector and outcoupling grating, as this would destroy the intended purpose of Ono's invention. A *prima facie* case of obviousness cannot be properly based upon a prior art reference if the prior art reference requires some modification in order to be properly combined with another reference and such a modification destroys the intended purpose or function of the disclosed invention in the reference.

In the present case, Ono teaches that the two reflector gratings are separated by a gain region and phase adjustment portions, as described below. This teaching of Ono makes implementing the teaching of Lo impossible.

Ono teaches an edge emitting laser (*See, e.g.*, col. 2 lines 56-60 discussing prior art) that uses the space on top of the device for placing electrodes used to control the emission spectrum of the laser diode. In other words, by pumping regions 14 and 16 differently, the device can be made to emit different wavelengths due to internal plasma effects. (*See* Ono Abstract; col. 6 lines 7-13.) Grooves 19, 19' and 19" are used for electrical isolation.

Modifying Ono to implement Lo's teaching of a grating that both reflects and couples light out of the device is not compatible with the rest of Ono's teaching. Neither reflector grating 18, 18' of Ono can be made like the varied-period gratings 106, 108 of Lo. This is evident by the teaching of Ono at col. 4, lines 50-54, which describes cladding layers 13 placed atop gratings 18, 18', as well as electrodes 14 and 14' which are used to tune the output of the laser diode of Ono. (*See* FIG. 3, Ono.) Placing these structures, which are essential to Ono's invention, atop the reflector gratings 18, 18' prevents using those gratings as outcoupling gratings. This is why Ono teaches an edge emitting device and does not outcouple light from the top of the device.

Thus, the Ono would have to be significantly modified in order to implement the teaching of Lo, as Examiner proposes. But the modifications required would destroy the intended purpose of Ono, as it would eliminate the ability to place tuning electrodes 14, 14' atop Ono's device.

It is also respectfully asserted that the references would not suggest such modifications to one of ordinary skill in the art. The Examiner may not make modifications to the prior art using the claimed invention as a model for the modifications. *In re Fritch*, 972 F.2d 1260, 23 U.S.P.Q.2d 1780, 1783-1784 (Fed. Cir. 1992). "The mere fact that the prior art may be modified in the manner suggested by the Examiner does not make the modification obvious unless the prior art has suggested the desirability of the modification." *Id.* In other words, unless some teaching exists in the prior art for the suggested modification, merely asserting that such a modification would be obvious to one of ordinary skill in the art is improper and cannot be used to meet the burden of establishing a *prima facie* cases of obviousness. Such reliance is an impermissible use of hindsight with the benefit of applicant's disclosure.

For the above reasons, it is respectfully believed that Claim 1 is distinguished from the cited references and is in condition for allowance.

Claims 7 and 27 are also believed allowable over the cited references. Independent Claim 7 states:

7. A semiconductor laser device, comprising:

a waveguide structure having first and second reflectors, one at either end of said waveguide;

a first set of electrodes connected to pump a first gain region portion of said waveguide structure adjacent to said first reflector;

a second set of electrodes connected to pump a second gain region portion of said waveguide structure adjacent to said second reflector;

an outcoupling aperture positioned between said first and second gain region portions on said waveguide structure, connected to couple light out of said waveguide structure.

In rejecting Claim 7, the Examiner again points to Ono and Lo, citing the same passages against Claim 7 as were cited against Claim 1, and adding on page 4 of the Office Action that,

> Ono has a first set of electrodes made up of electrodes 16 and 17 to modulate the light. Ono has a second set of electrodes made up of electrodes 15 and 17. Ono has an active region 12 located between the reflectors. As is evident in FIG. 3 Ono, the gain region has a plurality of sections.

It is noted that Ono does not show a first gain region portion and a second gain region portion. Examiner only cites one gain region in Ono, active region 12, which is adjacent to one of the reflectors 18. Ono shows no teaching of the second gain region portion which is claimed as adjacent to said second reflector. Hence, the combination of Ono and Lo fail to show the claimed limitations of

> a first set of electrodes connected to pump a first gain region portion of said waveguide structure adjacent to said first reflector;
>
> a second set of electrodes connected to pump a second gain region portion of said waveguide structure adjacent to said second reflector;

(Emphasis added.)

In Ono, the second set of electrodes 16 is used to change the phase of light in the waveguide, so as to manipulate the frequency of light emitted from the device. This is described in Ono at col. 6, lines 7-10:

In the semiconductor laser element prepared as described above, when the current I_{tune} and the voltage E_{phase} were changed, an emission wavelength was changed within the range of 0.855 to 0.845 um.

In this passage, E_{phase} is controlled by the voltage applied to electrode 16 of FIG. 3. The regions directly below electrode 16 are layer 13, which is a cladding layer, and layer 20, which is the waveguide for the laser. Neither of these regions is portrayed as a "gain region" in Ono, and electrode 16 is not positioned "adjacent to said second reflector" since Ono's FIG. 3 shows regions 19 and 21 (section L_d) between electrode 16 and reflector 18'. Therefore electrode 16 cannot fulfill the claimed limitation of, "a second set of electrodes connected to pump a second gain region portion of said waveguide structure adjacent to said second reflector."

Hence, it is respectfully asserted that the combination of Ono and Lo fails to teach all the claimed limitations of at least Claim 7.

Furthermore, it is believed that Lo and Ono cannot be properly combined in this way. As described above with respect to Claim 1, Lo's FIG. 11 teaches a device that shows no contacts, and integral gratings of varying phase. Lo also teaches no structure between the reflectors of its laser device, while the present Claim 7 claims two gain region portions each with their own pumping electrode, all positioned between the reflectors of the system. (It is noted that the other devices taught in Lo are VCSELs, which are not analogous to the horizontal cavity surface emitting laser of the present invention.)

Hence, it is respectfully asserted that combining Lo and Ono to form the present invention would not have been obvious to one of ordinary skill in the art. Claim 17 is therefore believed distinguished from the cited references.

Independent Claim 14 includes the limitation, "a gain region of said cavity located between said reflectors, said gain region having a first portion on one side of said outcoupling aperture and a second portion on the opposite side of said outcoupling aperture."

This limitation is not shown in any of the cited references. As described above, Ono shows no outcoupling aperture and is incapable of adding an outcoupling aperture to the surface of its device as this would interfere and prevent with the intended purpose of Ono's wavelength modulation teaching. Likewise, Lo shows no gain region portions on opposite sides of an outcoupling aperture.

For these reasons and those argued with respect to Claims 1 and 7, Claim 14 is believed distinguished from the cited references.

Independent Claim 21 claims

21. A semiconductor laser system, comprising:

a cavity having reflectors at either end and an outcoupling aperture connecte to outcouple light from said cavity, said outcoupling aperture located between said reflectors;

a gain region of said cavity located between said reflectors;

a reflective layer positioned on said outcoupling aperture.

This claim is believed distinguished from the cited references by virtue of the arguments applied to Claims 1, 7, and 14 above. Furthermore, it is respectfully believed that Miyake does not show an outcoupling aperture with a reflective layer as characterized by the Examiner, but instead a holographic mirror with a reflective layer. At page 5 of the Office Action, Examiner states,

> However, Miyake teaches these limitations. FIG. 1 of Miyake shows the outcoupling aperture A being used in a laser system....

Reference to the text of Miyake shows that element A of FIG. 1 is only the substrate for a holographic mirror. (*See* Miyake at col. 4, lines 22-25.) Furthermore, Examiner later states, "A closeup view is shown in FIG. 2. The outcoupling aperture 2 is comprised by a grating 13a made on the surface 13 of a substrate...."

Applicant respectfully points out that Examiner has mixed the elements of Miyake. Aperture 2 is part of the HOE-LD-PD unit (*see* col. 1, lines 64-66; *see also* FIGs. 1-2) while the grating 13a and surface 13 are part of hologram mirror 12. Hologram mirror 12 is not an aperture, as characterized by the Examiner. The aperture which Examiner refers to is part of the device which shines light onto the mirror 12, the light striking a recording medium, reflecting back to mirror 12 and again back to the HOE-LD-PD device through aperture 2 of that device. In short, FIG. 2 does not detail aperture 2 of FIG. 1, but rather FIG. 2 details the holographic mirror 12. (*See* col. 4, line 22: "FIG. 2 shows a cross section of hologram mirror 12.")

Hence, it is respectfully asserted that Miyake does not show the limitation of , "a reflective layer positioned on said outcoupling aperture," as claimed in Claim 21.

Dependent Claims 3 and 29 are rejected over the above references along with Strasser , which Examiner cites as showing the claimed limitation of, "wherein said light is coupled out at an angle other than the normal to the surface of said device," as claimed in at least Claim 3.

In rejecting these claims, the Examiner states:

> Claims 3, 10 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ono in view of Lo and Miyake as applied to claims 1, 2, 4-9, 12-15, 17, 18, 20, 21, 23 and 25-28 above, and further in view of Strasser et al. US 5,363,226 (herein after known as Strasser). Ono in view of Lo teaches the invention as outlines in the rejection above, but fails to teach a light outcoupling angle other than a normal angle. However, Strasser teaches this in Fig. 1 of his patent. Surface grating 11 in Fig. 1 shows a reflection of other than a normal angle. Gratings can be designed to reflect light in this way. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Ono in view of Lo as taught by Strasser since it is known in the art to do so. Furthermore, the grating has a non-circular footprint.

However, Strasser's FIG. 1 does not show light being coupled out at an angle other than the normal. FIG. 1 of Strasser shows instead a reflection off a grating, wherein the reflection is determined by the grating and is not normal to the surface of the grating.

This does not teach the claimed limitations of Claims 3 and 29 since these claims require that light be coupled out of an aperture at an angle other than the normal to the surface.

Hence, it is respectfully believed that all claims are distinguished from the cited references, and that they are in condition for allowance. Favorable reconsideration of the claims is respectfully requested.

IV. Conclusion

It is respectfully urged that the subject application is patentable over the cited references and is now in condition for allowance.

The examiner is invited to call the undersigned at the below-listed telephone number if in the opinion of the examiner such a telephone conference would expedite or aid the prosecution and examination of this application.

DATE: 1.24.03

Respectfully submitted,

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